Remarks/Arguments

Favorable consideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 3, 4, and 11 are pending in the application, with Claims 3, 4, and 11 amended and Claims 1, 2, 5-10, and 12-17 cancelled by the present amendment.

In the outstanding Office Action, Claims 1 and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by Ishii et al. (U.S. Patent No. 5,571,366, hereinafter Ishii); Claims 1 and 11 were rejected under 35 U.S.C. § 102(e) as being anticipated by Lee et al. (U.S. Patent No. 6,288,493, hereinafter Lee); Claim 4 was rejected under 35 U.S.C § 103(a) as being unpatentable over Lee; Claim 3 was rejected under 35 U.S.C § 103(a) as being unpatentable over Lee in view of Holland et al. (U.S. Patent No. 5,800,619, hereinafter Holland); Claim 4 was rejected under 35 U.S.C § 103(a) as being unpatentable over Ishii; and Claim 3 was rejected under 35 U.S.C § 103(a) as being unpatentable over Ishii in view of Holland.

Claim 3 is amended to more clearly describe and distinctly claim Applicants' invention. Claim 4 is amended to depend from independent Claim 3. Independent Claim 11 is amended to recite the power supply antenna features of Claim 3. No new matter is added.

In view of the cancellation of Claim 1 and the amendments to Claims 4 and 11, the outstanding rejections of Claims 1, 4, and 11 are moot.

Briefly recapitulating, Claim 3 is directed to a power supply antenna, comprising a plurality of coils disposed concentrically, the plurality of coils being prepared by bending a plurality of conductors each into a form of an arc. Power supply portions, formed at opposite ends of the respective coils so as to be connected to a high frequency power source, are located in different phases on a same plane. At least one of the coils is disposed on a plane other than the same plane and is configured to vary mutual inductances so that a distribution

of energy absorbed in a plasma is adjusted. The claimed antenna provides a strong plasma distribution in the form of a doughnut below the antenna coils. By placing the power supply portions in different phases on a same plane, electric fields generated at the power supply portions are optimally inhibited from disturbing the plasma.[1] The power supply portions of one turn[2] or plural turns[3] are disposed at optimal positions in order to prevent the occurrence of nonuniformity of the plasma due to voltage generated at the connection ends of the power supply portions. This measure achieves the effect of lessening the nonuniformity in the circumferential direction where "FIG. 8 shows that a horizontal surface including the vertical (z-direction) position of the coil li is displaced by a distance L with respect to a horizontal surface including the vertical (z-direction) positions of the other coils la, 1b."[4]

Ishii discloses an antenna comprising divisional antennas and designed to decrease plasma density in the central portion of the antenna and uniformize plasma density in the radial direction as compared with a spiral coil.[5] In this regard, similar to Applicants' Figure 2, Ishii discloses a structure in which "the first one-turn radio frequency coil 116 and the second one-turn radio frequency coil 117 are coaxially arranged on the same plane at predetermined intervals."[6] However, Ishii does not disclose placing corresponding divisional antenna power supply portions "in different phases on a same plane" as recited in Applicants' independent Claim 3. In fact, nowhere in the Ishii reference is there any teaching of divisional antenna power supply portions, let alone a placement of these power supply portions. Nor is there any mention of coil-related electromagnetic field phase variation that would suggest placing power supply portions in predetermined positions. Instead, Ishii

[1] Specification, page 5, lines 3-24.
[2] Specification, Figure 2.
[3] Specification, Figure 3, 8.
[4] Specification, page 26, lines 5-15.
[5] Ishii, abstract.
[6] Ishii, column 16, lines 30-33; and Figure 24.

teaches numerous embodiments of control circuits directed to phase manipulation,[7] but none of these teachings mention coaxial displacement effects *due to power supply placement*. In addition, Applicants note Ishii describes seven specific methods for controlling plasma, including controlling the phase of the voltages to ensure uniform distribution of the plasma.[8] However, the plasma distribution of Ishii is being controlled in a radial distribution, not a circumferential distribution. Because there is no mention of circumferential plasma distribution and control, Applicants submit there is no suggestion or motivation in the teachings of Ishii for any particular power supply placement, let alone Applicants' claimed power supply placement.

For each of the above reasons, Applicants submit that Ishii fails to teach or suggest power supply portion placement of any kind, let alone placement "in different phases on a same plane" as recited in Applicants' independent Claim 3. Applicants therefore continue to traverse that a finding that Ishii teaches Applicants' claimed power supply placement and submit that such a finding is a result of impermissible hindsight reasoning.

Finally, as noted in the Official Action,[9] Ishii does not teach or suggest "at least one of the coils is disposed on a plane other than the same plane [and is configured] to vary mutual inductances so that a distribution of energy absorbed to a plasma is adjusted."

Lee discloses an antenna device with a two coaxial coil antennas, which like Ishii, includes an antenna structure[10] similar to Applicants' Figure 2. However, also like Ishii, Lee does not disclose placing corresponding power supply portions "in different phases on a same plane" as recited in Applicants' independent Claim 3. In fact, nowhere in the Lee reference is there any teaching of a specific placement of power supplies. Also Lee provides no teaching

[7] Ishii, Figures 26-31
[8] Ishii, column 26, lines 39-61.
[9] Official Action, page 7, lines 14-20.
[10] Lee, Figure 3B.

of a specific phase displacement of the two coaxial coils. Nor is there any mention of coil-related electromagnetic field phase variation due to power supply placement. Like Ishii, Lee teaches numerous embodiments of control circuits directed to phase manipulation, but none of these teachings mention power supply placement effects. For example, in Lee, "[t]he antenna device 100 also includes an impedance matching circuit 304 for achieving an impedance matching state between a plurality of antenna units 400a and 400b and the high frequency power source 102. At this time, a plurality of antenna units (400a, 400b) are kept in the resonant state by the variable load of the variable capacitor C_R 302a, which is the most important feature of the present invention."[11] Lee further discloses "[a]s a result, it is possible to efficiently transmit the energy supplied from the high frequency power source 102 to plasma 118 in the chamber 104 with an improved uniformity in the density of plasma."[12] However, the "uniformization of the plasma density" in Lee means the uniformization of the plasma density in the radial direction, not in the circumferential direction.

Therefore, for each of the above reasons Applicants submit Lee fails to teach or suggest power supply portion placement of any kind, let alone placement "in different phases on a same plane" as recited in Applicants' independent Claim 3. Applicants therefore continue to traverse that a finding that Lee teaches Applicants' claimed power supply placement and submit that such a finding is a result of impermissible hindsight reasoning.

Finally, as noted in the Official Action, [13] Lee does not teach or suggest "at least one of the coils is disposed on a plane other than the same plane [and is configured] to vary mutual inductances so that a distribution of energy absorbed to a plasma is adjusted."

Applicants have also considered the Holland reference and submit Holland does not cure the deficiencies of either Ishii or Lee. Applicants first submit that Holland also does not

[11] Lee, column 3, lines 49-58
[12] Lee, column 4, lines 29-32

teach or suggest "power supply portions, formed at opposite ends of the respective coils so as to be connected to a high frequency power source, are located in different phases on a same plane" as recited in Applicants' Claim 3.

Furthermore, Holland discloses "[t]he electric source includes substantially planar coil 24, usually mounted immediately above window 19"[14] and alternative embodiments that include "positioning the coils... in many different planes above window 19."[15] However, Holland does not teach or suggest that "at least one of the coils is disposed on a plane other than the same plane and is configured to vary mutual inductances so that a distribution of energy absorbed to a plasma is adjusted" as recited in Applicants' Claim 3. In fact, Holland does not even teach or suggest that the respective coils are arranged parallel to one another let alone teach or suggest adjusting the vertical distance L between the coils to vary mutual inductances so that the distribution of energy absorbed to the plasma is adjusted. Applicants submit that there is neither a teaching, suggestion, nor motivation to infer that the teachings of Holland rise to a level necessary to correct the deficiencies of Ishii or Lee.

By way of example, Applicants note that their claimed invention provides that an optimum energy distribution can be obtained by adjusting a distance L between the coils that is inherent in the present invention. By adjusting the distance L, mutual coil inductances are adjusted in an improved and easy-to-control manner. Additionally, Applicants' claimed antenna coil is generally made of a hard material, such as a copper pipe. Thus, once the antenna coil is produced, it is virtually impossible to change its physical characteristics (e.g., diameter). However, with the claimed invention, desired adjustments can be made by changing the height position of a predetermined coil.

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[13] Official Action, page 6, lines 11-15.
[14] Holland, column 7, lines 2-8.
[15] Holland, column 14, lines 11-24.

Applicants also note that in antenna structure of Holland a nonuniform component is generated in the plasma within the chamber 10 mounted in a direction parallel to the dielectric window 19. Thus, Holland states that the most uniform plasma can be generated, if the inclination angle between the coil plane and the window 19 is set at about 9 to 18 degrees.[16] However, with Applicants' claimed "at least one of the coils...disposed on a plane other than the same plane," the nonuniform component of Holland is not generated. Thus, with Applicants' claimed invention, there is no need to consider providing any coil inclination to maintain plasma stability.

The present amendment is submitted in accordance with 37 C.F.R. § 1.116 which permits amendments placing the claims in better form for consideration on appeal after final rejection. Since the present amendment clarifies the claimed invention, it is respectively requested that 37 C.F.R. § 1.116 be liberally construed and the present amendment be entered.

Accordingly, in view of the present amendment and in light of the previous discussion, Applicants respectfully submit that the present application is in condition for allowance and respectfully request an early and favorable action to that effect.

Respectfully submitted,

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[16] Holland, column 13, lines 36-45; Figure 10.